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(73) Proprietor: **AMERICAN NATIONAL CAN COMPANY**
8770 West Bryn Mawr Avenue
Chicago, Illinois 60631(US)

(72) Inventor: **Puiciani, Sam C.**
4633 North Ozark Avenue
Oak Forest, IL 60452(US)
Inventor: **Mikas, Raymond**
8137 South Sawyer
Chicago, IL 60652(US)
Inventor: **Wyleta, Robert M.**
5525 West 83 Place
Burbank, IL 60459(US)
Inventor: **Szczerba, Robert M.**
800 Willy Avenue
Algonquin, IL 60102(US)

(74) Representative: **Strehl, Schübel-Hopf, Groening**
Maximilianstrasse 54 Postfach 22 14 55
W-8000 München 22 (DE)

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Description

A container of the type according to the pre-characterising part of claim 1 is known from WO-A-83/02577.

A hollow support surface of this known container extends around the central domed panel. The support surface is incorporated in a transitional portion connecting the periphery of a central panel to the side wall. The transitional portion consists of an annular wall extending from the periphery of the central panel to an outwardly convex bead of arcuate cross-section forming the support surface on which the can body may stand. The bottom wall shape enables filled cans to be stacked. The beads can be engaged in a lid of another can within the double seam produced when fixing the lid to the can body. In addition, the double seam is arranged to nest in the concavity.

In an effort to reduce the cost of finished containers, manufacturers are constantly striving to reduce the thickness of the initial stock material, thereby decreasing the overall metal cost of each container. Since the end wall (bottom) of the container essentially represents the initial thickness of the can stock, new bottom profiles are required to maintain the pressure performance of thinner gauge of stock materials. Purchasers and users of such containers, particularly the beer and beverage industry, have very stringent requirements which require that the finished and filled container be capable of maintaining internal pressures above 7.03 kg/cm (100 psi) minimum without any significant distortion, and to provide such capability, rather elaborate dome or end configurations have been developed.

Another more recent requirement for such drawn and ironed containers is that the container must have a minimum resistance to the reversal of the end wall when the container is inadvertently dropped after it has been filled and is ready for sale and that the end wall have a buckle resistance of more than 7.03 kg/cm (100 psi).

However, as the thickness of the stock material decreases, the problem of wrinkling the container shell wall becomes more acute, particularly when attempting to produce the more elaborate configurations in the end wall.

One problem that has recently received some attention is the handling of the containers, particularly during shipment, storage and display. With the increased use of the reduced end necked portion on the upper end of the container, allowing for the use of smaller ends as part of the package, one of the problems that has been encountered is stability of the containers, particularly when several six-ing the goods on shelves. While this has to some degree been a problem in the industry, no particular attention has been given to solutions for accomodating proper stacking and interlocking of a plurality of containers on a shelf.

According to the present invention, the container can be formed using reduced thickness stock material without increasing the diameter of the disc-shaped stock material. The new container has excellent column strength, buckle strength and resistance to harsh handling, while a the same time incorporates a nesting feature for allowing the bottom profile wall to nest with the end attached to the reduced neck portion of the container.

The bottom profile includes a spherically, inwardly-domed portion surrounded by a generally U-shaped annular segment defining a lower support for the container with the annular segment preferably having a diameter of about 80% of the diameter of the side wall. A specifically configured annular joining segment is integral with the side wall and the U-shaped annular segment with the joining segment including a first annular arcuate portion having an interior radius and a second annular arcuate portion having an exterior radius to produce an annular support point for nesting with an end on an adjacent container.

The particular domed profile is configured to eliminate the need of any metal reversal during the formation of the bottom profile at the end of a drawing and ironing operation, and the profile incorporates specifically, dimensioned radii and segments that simplify the metal-deforming process so that the containers can be manufactured at acceptable production rates.

Brief Description of Drawing

Fig. 1 is a fragmentary cross-sectional view of the container having the present invention incorporated therein;

Fig. 2 is an enlarged fragmentary cross-sectional view of the container shown in Fig. 1, along with the tooling for forming the bottom profile;

Fig. 3 is an enlarged fragmentary segment of the container bottom profile;

Fig. 4 is a perspective view of a container having an end seamed thereto;

Fig. 5 is a fragmentary cross-sectional view showing two containers in nesting relation to each other.

Detailed Description

Fig. 1 of the drawings discloses a fragmentary portion of a container, generally designated by

drical side wall 12 and an integral end wall 14. Container 10 is what is commonly known as a "drawn and ironed container" wherein a flat circular metal disc is converted into a shallow cup in a press, commonly referred to as a "cupper". The shallow cup is then delivered to a drawing and ironing machine, commonly referred to as a "bodymaker" wherein the cup is reformed to reduce the diameter thereof and increase the height by reducing the thickness of the side wall. The end wall is subsequently reformed at the end of the stroke of the punch that forms part of the press or bodymaker. After the end wall or bottom has been reformed to the particular bottom profile, the container has a reduced neck 16 formed around the open end and an outwardly-directed flange 18 with the flange being utilized for double-seaming an end thereto.

With the increased attention in reduction of metal costs, many manufacturers are now utilizing what is referrred in the industry as a "206 End" rather than the prior most common "209 End", the numerical values indicating the effective diameter of the end, which also dictates the amount of metal required for forming the end. With the use of the "206 End" and a substantially reduced neck on the upper end of the container, the problem of stacking several groups of containers upon each other has become more acute. Most commercially-available containers use a bottom profile having an outwardly-convex peripheral annular segment surrounding a reduced diameter lower support surface and an inwardly-domed central portion inside the annular support surface.

The bottom profile of the drawn and ironed container is configured such that the bottom of one container will nest within the end of an adjacent container attached to the reduced neck and the container is still capable of withstanding internal pressures in the order of 7.03 kg/cm^2 (100 psi) and also has a column strength of approximately 159 kg (350 pounds) or greater. Moreover, the present container has exhibited excellent results in drop-tests that have recently become a criteria in the beer and beverage industry.

According to the present invention, the lower end 14 of the container 10 includes a center domed portion 20 (Fig. 3) surrounded by an annular U-shaped portion 22 and an annular joining segment 24 integral with the side wall 12 and the U-shaped portion 22.

As shown in Fig. 3, the center domed portion 20 has a spherical radius R1 and is joined to the U-shaped portion by an arcuate segment 26 having a radius R2. The U-shaped portion 22 includes an annular, substantially vertical wall 28 and an outer

R3. The lower segment 32 defines an annular support surface 34 for the container 10. The inner annular wall 28 is substantially vertical and defines an included angle with respect to a vertical axis (not shown) through the container which is as close to zero as possible, while the outer annular wall 30 defines an angle A.

The joining segment 24 includes a first annular arcuate portion 36 having an exterior radius R4 and a second annular arcuate portion 38 having an interior radius R5.

The particular radii and dimensions of the various parts that form the integral lower end 14 of the container are important to the overall performance of the container when filled with pressurized contents and also incorporates a nesting feature which will preclude "wobbling" when two filled containers are stacked on each other.

A specific set of parameters will now be described with the understanding that some of these parameters may be varied without departing from the spirit of the present invention.

A container having a cylindrical side wall diameter D1 of 65.964 mm (2.597 inches) was formed from a flat circular disc having a diameter of 139.573 mm (5.495 inches) and a thickness of 0.3251 mm (0.0128 inch). The disc was first converted into a cup and then converted to a finished drawn and ironed container using tooling shown in Fig. 2, to be described later.

The container center dome 20 has a spherical radius R1 of 53.848 mm (2.120 inches) with the radius R2 of segment 26 being 1.27 mm (0.050 inch).

The lower annular arcuate support had a radius R3 of 1.016 mm (0.040 inch) and the angle A for wall segment 30 was 27°30' and the angle for wall segment 28 was less than 5°, preferably as close to vertical as possible. The exterior radius R4 was 2.54 mm (0.100 inch), while the interior radius R5 was 5.08 mm (0.200 inch).

The support diameter D2 for the container was 50.80 mm (2.000 inches), while the diameter D3 for the center of the radius R4 was 60.071 mm (2.365 inches) and the diameter D4 for the center of the radius R5 was 55.55 mm (2.187 inches).

This type of container was then filled with beverage and an end 40 was seamed to the reduced neck portion 16 by a double seam 42 (Fig. 4). The end was a standard commercial 206 End.

This container was tested extensively and was found to meet or exceed all minimum requirements for the beer and beverage industry. Furthermore, filled containers, when stacked upon each other, had a good snug fit with continuous contact around the entire periphery.

Actual tests were conducted on this and it was

"206 End" double seamed to the opposite end of the container after it was filled with a product and did not "rock". Dome reversal tests were then conducted using a bottom profile having a dome height of 0.9906 cm (0.390 inch), measured from the lower center of the dome to the bottom edge of the container, and it was determined that it withstood pressures of 6.995 kg/cm^2 (99.5 psi) before dome reversal occured. This figure is well above the minimum requirements for this container.

Fig. 5 of the drawings shows the nesting relation between two containers stacked upon each other. It should be noted that the annular arcuate segment 36 has continuous extended contact with the double seam 42 and the U-shaped annular segment 22 is partially wedged into the double seam to prevent tilting of the upper container with respect to the lower container.

While the relative dimensions and their relation have not been fully explored, it is believed that some of the relationships are critical to the overall success in performance of the container. For example, in the specific container described, the diameter D2 was less than 80% of the, diameter D1 of the container. The relationship between the diameter of the support surface 34 and the spherical radius R1 of dome 20, along with the vertical annular wall 28, is believed to add strength characteristics. Also, the fact that the joining segment has two arcuate segments 36 and 38 having significantly different radii, with radius R5 being about twice the radius R4, provides excellent internal pressure resistance.

Fig. 2 of the drawings shows the tooling used for forming the bottom profile of the present invention. The tooling includes a center dome pad 50, an outer annular forming element 52 and a punch 54. The center dome pad 50 has an upper spherical surface 56 having a radius R1 and a peripheral edge having a radius R2, along with a peripheral vertical surface 58. The outer annular forming element 52 has an inclined flat surface 60, a convex annular surface 62 having a radius R4, and a concave annular surface 64 having a radius R5. The punch 54 has a lower nose 70 configured to produce the U-shaped portion 22 and an outer surface 72 conforming to the surfaces 62 and 64.

Containers constructed in accordance with the present invention exhibited more than adequate resistance to buckling, internal pressure and column strength. It has also been noted that the stock material thickness could be reduced to 0.3175 cm ((0.0125 inch), and possibly as low as 0.3048 cm (0.0120 inch), which significantly reduces the raw material cost for these containers.

It should also be noted that the tapered upper end 18 of the container is a constantly-reducing flange 18. This constantly-reducing tapered smooth neck is produced in a spin-necking operation and tests have shown that this results in significantly increased crush strength for the container. In fact, these tests show that the upper edge of the neck will actually curl rather than having the tapered portion wrinkle.

As indicated above, one of the problems encountered in forming container shells from reduced thicknesses of aluminum stock material and reforming the end wall of the configuration described above is that the metal has a tendency to wrinkle, particularly in the reformed juncture area, which renders the finished container unacceptable.

Claims

1. A drawn and ironed beer and beverage container (10) including a generally cylindrical side wall (12) having
a neck (16) at one end with an end (40) connected by a double seam (42) to an open end of said neck (16),
said double seam (42) having an inner generally flat wall that extends generally parallel to the axis of said container (10) with an upper arcuate exposed portion above said inner flat wall and an integral bottom wall,
said bottom wall including a first lower convex annular arcuate portion (38) at the end of said cylindrical side wall (12),
a concave annular second arcuate portion (36) integral with a lower end of said first lower convex annular arcuate portion (38) and a generally U-shaped annular third portion (22),
said arcuate exposed portion of the double seam (42) adapted when a lower portion of a container is (10) is stacked upon an upper portion of another container of the same shape (10) to nest in said second arcuate portion (36),
said U-shaped annular third portion (22) having an inner substantially vertical flat wall (28) interconnected by a lower arcuate segment (32) that defines a reduced diameter lower annular support (34) for said container (10); and
an inwardly domed central panel (20) integral with said substantially vertical flat wall (28),
characterized in that
said U-shaped annular third portion (22) has an outer annular flat wall (30) tapered inwardly,
said bottom wall has a profile adapted to wedgingly nest with a reduced end seamed to said open end of said other container
said second arcuate portion (36) of the bottom wall is adapted to engage said arcuate exposed portion of the double seam (42) and to

its entire periphery when a lower portion of a container (10) is stacked upon an upper portion of said other container (10).

2. A drawn and ironed beverage container as defined in claim 1 characterized by said first arcuate portion (38) having a radius which is twice the radius of said second arcuate portion (36).

3. A drawn and ironed beverage container as defined in claim 1 or 2, characterized by said inwardly-tapered neck (16) being generally smooth and continuous between said side wall (12) and said double seam (42).

4. A drawn and ironed beverage container as defined in claim 1, 2 or 3, characterized by the radius of said first arcuate portion (38) being one-tenth the diameter of said lower support (34) and the radius of said second arcuate portion (36) being one-half the radius of said first arcuate portion (38).

5. A drawn and ironed beverage container as defined in claim 1 or 2 in which the diameter of said lower annular support is 5.08 cm (2.00 inches) and is 80% of the diameter of said side wall (12).

Patentansprüche

1. Tiefgezogener und abgestreckter Bier- und Getränkebehälter (10), umfassend eine im allgemeinen zylindrische Seitenwand (12) mit einem Hals (16) an einem Ende, wobei ein Ende (40) durch einen Doppelfalz (42) mit einem offenen Ende des Halses (16) verbunden ist,
der Doppelfalz (42) eine im allgemeinen ebene Innenwand, die sich im allgemeinen parallel zu der Achse des Behälters (10) erstreckt, mit einem oberen, gekrümmten, freiliegenden Teil oberhalb der ebenen Innenwand und eine integrale Bodenwand hat,
die Bodenwand einen ersten, unteren, konvexen, ringförmigen, gekrümmten Abschnitt (38) an dem Ende der zylindrischen Seitenwand (12),
einen konkaven, ringförmigen, zweiten, gekrümmten Abschnitt (36), der einheitlich mit dem unteren Ende des ersten, unteren, konvexen, ringförmigen, gekrümmten Abschnitts (38) ausgebildet ist, und einen im allgemeinen U-förmigen, ringförmigen, dritten Abschnitt (22) aufweist, wobei
der gekrümmte, freiliegende Abschnitt des Doppelfalzes (42) in den zweiten, gekrümmten Abschnitt (36) der Bodenwand eines Behälters (10) auf einen oberen Teil eines anderen Behälters (10) gleicher Form aufgesetzt wird,
der U-förmige, ringförmige, dritte Abschnitt (22) eine im wesentlichen senkrechte, ebene Innenwand (28) hat, die mit einem unteren, gekrümmten Segment (32) verbunden ist, das eine untere, ringförmige Stütze (34) verringerten Durchmessers für den Behälter (10) bildet; und
eine nach innen gewölbte, mittlere Platte (20) mit der im wesentlichen senkrechten, ebenen Wand (28) einheitlich ausgebildet ist,
dadurch gekennzeichnet, daß
der U-förmige, ringförmige, dritte Abschnitt (22) eine äußere, ringförmige, ebene Wand (30) hat, die nach innen verjüngt ist,
die Bodenwand ein Profil hat, mit dem sie mit einem reduzierten Ende in das offene Ende des anderen Behälters keilartig eingefügt werden kann,
der zweite, gekrümmte Abschnitt (36) der Bodenwand an dem gekrümmten, freiliegenden Abschnitt des Doppelfalzes (42) anlegbar ist, um einen kontinuierlichen, ausgedehnten Kontakt rund um seinen gesamten Umfang zu bilden, wenn ein unterer Teil eines Behälters (10) auf einen oberen Teil des anderen Behälters (10) gestapelt wird.

2. Tiefgezogener und abgestreckter Behälter nach Anspruch 1, dadurch gekennzeichnet, daß der erste, gekrümmte Abschnitt (38) einen Radius hat, der das Zweifache des Radius' des zweiten, gekrümmten Abschnitts (36) ist.

3. Tiefgezogener und abgestreckter Behälter nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der nach innen verjüngte Hals (16) zwischen der Seitenwand (12) und dem Doppelfalz (42) im allgemeinen glatt und kontinuierlich ausgebildet ist.

4. Tiefgezogener und abgestreckter Behälter nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß der Radius des ersten, gekrümmten Abschnitts (38) ein Zehntel des Durchmessers der unteren Stütze (34) ist und der Radius des zweiten, gekrümmten Abschnitts (36) dem halben Radius des ersten, gekrümmten Abschnitts entspricht.

5. Tiefgezogener und abgestreckter Behälter nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Durchmesser der unteren, ringförmigen Stütze 5.08 cm (2.00 inches) beträgt und 80% des Durchmessers der Seiten-

Revendications

1. Un récipient pour bière et boissons (10) étiré et en fer comprenant une paroi latérale (12) généralement cylindrique ayant
un col (16) au niveau d'une extrémité, avec une extrémité (40) reliée par un joint double (42) à une extrémité ouverte dudit col (16),
ledit joint double (42) ayant une paroi interne généralement plate s'étendant en position généralement parallèle par rapport à l'axe dudit récipient (10), avec une partie supérieure arquée exposée au dessus de ladite paroi interne plate et une partie de fond intégrale,
ladite paroi de fond comprenant une première partie inférieure convexe annulaire arquée (36) située à l'extrémité de ladite paroi latérale cylindrique (12), une seconde partie arquée concave annulaire (36) se raccordant à une extrémité inférieure de ladite première partie inférieure convexe annulaire arquée (38) et une troisième partie annulaire généralement en forme de U (22),
ladite partie exposée arquée du joint double (42) étant adaptée, lorsqu'une partie inférieure d'un récipient (10) est empilée sur une partie supérieure d'un autre récipient de forme identique (10), pour se loger dans ladite seconde partie arquée (36),
ladite troisième partie annulaire en forme de U (22) étant munie d'une paroi interne plate substantiellement verticale (26) interconnectée par un segment arqué inférieur (32) qui définit un support annulaire inférieur de diamètre réduit (34) pour ledit récipient (10); et
un panneau central ayant la forme d'un dôme se projetant vers l'intérieur (20) faisant partie intégrante de ladite paroi plate substantiellement verticale (28),
caractérisé en ce que
ladite troisième partie annulaire en forme de U (22) est munie d'une paroi externe annulaire plate (30) conique et se dirigeant vers l'intérieur,
ladite paroi de fond a un profil lui permettant de venir se loger par coincement sur une extrémité réduite joints sur ladite extrémité ouverte dudit autre récipient,
ladite seconde partie arquée (36) de la paroi de fond est adaptée pour s'engager sur ladite parti arquée exposée du joint double (42) et pour définir un contact étendu continu autour de toute sa périphérie lorsqu'une partie inférieure d'un récipient (10) est empilée sur une partie supérieure dudit autre récipient (109).

en ce que ladite première partie arquée (38) a un rayon qui est du double du rayon de ladite second partie arquée (36).

3. Un récipient pour bière et boissons (10) étiré et en fer selon la revendication 1 ou 2, caractérisé par un col conique se dirigeant vers l'intérieur (16) qui est généralement lisse et continu entre ladite paroi latérale (12) et ledit joint double (42).

4. Un récipient pour bière et boisson (10) étiré et en fer selon la revendication 1, 2 ou 3, caractérisé en ce que le rayon de ladite première partie arquée (38) est d'environ un dixième du diamètre dudit support inférieur (34) et en ce que le rayon de ladite seconde partie arquée (36) est d'environ la moitié du rayon de ladite première partie arquée (38).

5. Un récipient pour bière et boissons (10) étiré et en fer selon la revendication 1 ou 2, dans lequel le diamètre dudit support annulaire inférieur est de 5,08 cm (2,00 pouces) et est de 80 % du diamètre de ladite paroi latérale (12).

Fig. 1.

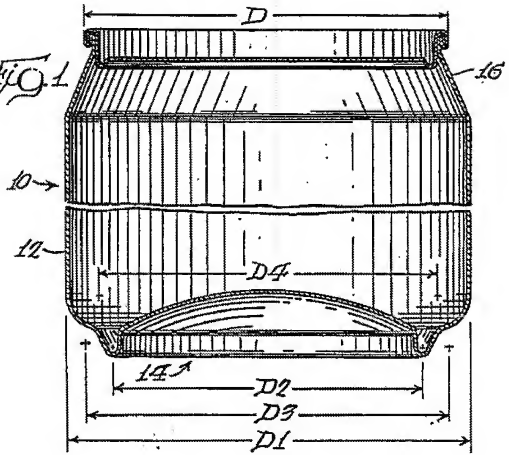

Fig. 2.

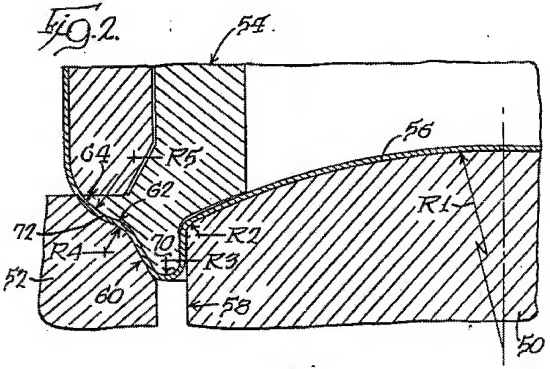

Fig.4.

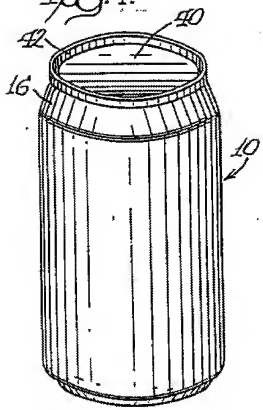

Fig.3.

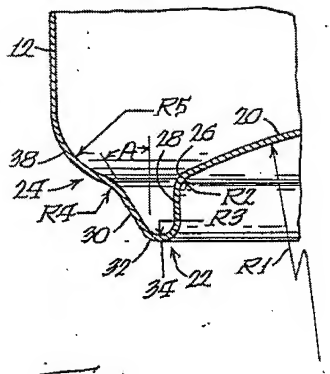

Fig.5.